Communication Network Comprising At Least A Source And A Switch For Receiving And Forwarding Data Packets Originated By The Source

CROSS REFERENCE TO RELATED APPLICATION

This application claims priority of European Application No. 02254976.0 filed on July 16, 2002.

FIELD OF THE INVENTION

The invention is related to a communication network comprising at least a source and a switch for receiving and forwarding data packets originating from the source, wherein the network comprises at least two mutually different routing paths between the source and the switch, wherein the switch comprises two incoming ports for receiving data packets originating from the source.

BACKGROUND OF THE INVENTION

Such communication network is known *per se*.

In use, one or more sources are directly or indirectly connected with the switch. If a source is directly connected with a switch, direct connections, referred to as paths, are for example present between the source and the switch. If a source is indirectly connected with the switch at least one other switch is present between the switch and the source. Between two switches there are often two mutually different routing paths. Each data packet generally comprises information with respect to the source the data packet originates from as well as information related to the destination address where to the data packet is sent. Each switch of the network is capable of extracting the information related to the destination address enabling the switch to forward the data packet into the right direction. Each switch is generally also capable of extracting from the data packet the source from which the packet originates.

In practice, there usually is a difference in length of time used for transferring a data packet originating from the source to the switch depending on the path used. The path followed over the network may sometimes have to be altered quickly during the transit of a number of data packets originating from the source. This need for a quick alteration of the path may, for instance, be a result of a link failure, a result of a desire to use a faster path, or the result of management action leading to the use of a different path. Such a quick change of a path may at some point in time lead to an arrival of the data packets at the switch in an order which is different from the order in which they were sent by the source.

For instance, let's assume that data packet X with a destination address B is sent from the source A before data packet Y with a destination address B is sent from the source A and that a change of path occurs during the transit of packet X and packet Y. If this change only leads to a new path for Y and this new path for Y is faster than the path used by X, packet Y will at some point arrive at the switch before packet X has arrived at that switch. In some uses of the network, such as the use of the network as a bridged Ethernet network, this re-ordering of the data packets during the transit causes problems with regard to the interpretation of such a re-ordered series of data packets at the final destination address B.

It should be noted that within the context of this specification data packets are said to have been re-ordered and an order of data packets is said to be different from an other order of the very same data packets if at least one data packet which was sent before an other data packet is received by a switch or a destination address after the other data packet has been received by that switch.

The problem of re-ordering during transit may be solved by providing each data packet with a sequence number to allow for ordering the data packets back into the order according to which the data packets were sent by the switch. This occurs in protocols such as TCP/IP. However, this leads to extra overhead in the length of a data packet and the packet processing.

It is an object of the invention to provide a communication network with a switch which is arranged to prevent re-ordering of data packets.

SUMMARY OF THE INVENTION

The object is achieved by a communication network according to the invention which is characterised in that the switch is arranged to discard for a period of time any data packet originating from the source at the first one of the at least two incoming ports upon receiving a data packet originating from the source at the second one of the at least two incoming ports after receiving a data packet originating from the source at the first one of the at least two incoming ports. This has the advantage that upon receiving a data packet originating from the source at the second one of the at least two incoming ports after receiving a data packet originating from the source at the first one of the at least two incoming ports another data packet from the source can for a period of time not be received at the first one of the at least two incoming ports. This other data packet originating from the source may have been sent from the source before the data packet received at the second one of the at least two incoming ports was sent from the source. By discarding this other data packet, re-ordering of data packets is prevented.

In a particular embodiment of a communication network according to the invention, the switch is further arranged to discard for a period of time any data packet originating from the source at all the at least two incoming ports apart from at the second one, upon receiving a data packet originating from the source at the second one of the at least two incoming ports after receiving a data packet originating from the source at the first one of the at least two incoming ports. In this case, at none of the at least two incoming ports apart from at the second one, data packets originating from the source are received. This is of particular interest in cases where the switch "learns" from the port at which a data packet originating from the source is received, which path should be followed by a data packet with the destination address of that source. In other words, if a switch receives a given data packet with a destination address, the switch will forward that given data packet from the

port at which it has just received another data packet from the source with that destination address. When packets from a certain source address arrive alternatingly at two ports of the same switch, also the forwarding of data packets to this source address will alternatingly occur from these two ports. The negative effect is that packets are likely to get lost. However, this particular embodiment prevents the continuous changing of ports from which data packets are forwarded.

In one embodiment of a communication network according to the invention, the period of time lasts till the switch is informed that re-ordering of the data packets originating from the source is no longer possible. This may be due to a management action or for instance to the fact that it is known that a last data packet of a series of data packets has arrived at its destination address. The predetermined length of time can be set such that it is highly likely that within the length of time a complete series of data packets will arrive at only one port of the switch.

Preferably the communication network according to the invention is characterized in that, the communication network is used by an Ethernet Network.

The invention is further related to a switch for use in a communication network which further comprises a source and, when the switch is in use, at least two mutually different routing paths between the source and the switch, wherein the switch is arranged to receive and forward data packets originating from the source, wherein the switch comprises at least two incoming ports for receiving the data packets originating from the source.

The invention is further related to a switch for use in such a communication network.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is herebelow explained by the following, non limiting example as illustrated in the drawing. Herein shows:

fig. 1 schematically a communication network according to the invention during a first stage of use;

fig. 2 schematically the communication network of figure 1 during a second stage of use;

fig. 3 schematically the communication network of figure 1 during a third stage of use;

fig. 4 schematically the communication network of figure 1 during a fourth stage of use;

fig. 5 schematically the communication network of figure 1 during a fifth stage of use;

fig. 6 schematically the communication network of figure 1 during a sixth stage of use;

fig. 7 schematically the communication network of figure 1 during a seventh stage of use;

fig. 8 schematically the communication network of figure 1 during a eighth stage of use;

fig. 9 schematically the communication network of figure 1 during a ninth stage of use;

fig. 10 schematically the communication network of figure 1 during a tenth stage of use

fig. 11 schematically the communication network of figure 1 during a eleventh stage of use.

DETAILED DESCRIPTION

Figure 1 shows a communication network N comprising switch S1 and a switch S2. The network N comprises between the switch S1 and switch S2 two paths I, II. Switch S2 comprises a port p2 for receiving packets originating from source A as forwarded by switch S1 along path II and a port p1 for receiving packets forwarded by switch S1 along path I. From source A the packets 1,2,3,4 are sent with destination address B. After forwarding data packet 1,2 from switch S1 along path I the route from switch S1 to switch S2 is

changed from path I to path II, as shown in figure 2. Hence, data packets 3,4 are forwarded along path II towards switch S2. Path II is in this example faster than path I. Figure 3 shows that data packet 1 is received at port p1 of switch S2, while data packet 2 is still travelling along path I and data packets 3,4 are still travelling along path II. As path II is faster than path I, data packet 3 is received at port p2 of switch S2 before data packet 2 has arrived at port p1 of switch S2. This is shown in figure 4.

According to the invention, in this situation data packets arriving at port p1 are for a period of time discarded once data packets forwarded by switch S1 are received at port p2 of switch S. Figure 5 shows in accordance with the invention that data packet 2 is not forwarded by switch S2 to destination B and figure 6 shows that data packet 2 is discarded by port p1 while data packet 4 is received at port p2 of switch S1. Within the context of this specification receiving a data packet implies accepting the data packet and if needed forwarding the data packet. Discarding a data packet implies not accepting the arrival of a data packet. It follows that data packet 4 is not discarded and is forwarded by switch S2 towards destination address B, finally leading to the arrival of data packets 1,3 and 4 at destination address B as shown in figure 7.

It is of course also possible that switch S2 comprises many more ports p1, p2, ... px for receiving data packets forwarded by the particular switch S1. In that case it is possible that instead of discarding data packets for a period of time only at port p1 upon receiving data packets at port p2, data packets are for a period of time discarded at all other ports p1,.....px apart from at port p2.

It is equally possible that the source is capable of sending data packets via two or more different paths to switch S1. Re-ordering is in this case prevented as long as switch S1 is arranged as switch S2, i.e. according to the invention. In other words, as long as switch S1 is arranged to discard for a period of time any data packet originating from the source at port p1 upon

receiving a data packet originating from the source at port P2 after receiving a data packet originating from the source at port p1, re-ordering is prevented.

Although the example only shows one source, it is also possible that a plurality of sources is capable of sending data packets to switch S1. As a switch is capable of extracting from the data packet information related to the source from which the data packet originates, the switch may according to the invention at one or more ports discard or accept data packets depending on the source from which the data packet originates.

A period of time may last till switch S2 is informed that re-ordering of the data packets originating from source A is no longer possible. It is however also possible that the period of time has a predetermined length of time which is for instance chosen such that it is unlikely that re-ordering is still possible once the predetermined length of time has passed. Figure 8 to figure 11 illustrate the situation after expiration the period of time, either due to the fact that the period of time comprises a predetermined length of time which has passed, or due to the fact that the switch has been informed that re-ordering of the data packet is no longer possible. Data packets 5,6,7 from source address A may for instance again be forwarded by switch S1 along path I towards switch S2. These data packets are in that case received by port p1 and all forwarded by switch S2 towards destination address B.

The communication network according to the invention is especially suitable if used by an Ethernet network.

It is of course possible that in a communication network according to the invention each switch comprises a switch which is being arranged to discard for a period of time any data packet originating from a source at port p1 upon receiving a data packet originating from that source at port p2 after receiving a data packet originating from the source at port 1. A network may comprise many switches and many paths between the switches. It is also possible that to each switch a number of end stations are connected. All these end stations have an address. Each of these variations and extensions are

understood to fall within the framework of the invention as defined by the appended claims.